J. Malac. Soc. Aust. 14: 107-112 1993

Redescription of the egg mass of *Melo miltonis* (Griffith and Pidgeon, 1834) (Mollusca, Prosobranchia, Volutidae)

Jørgen Knudsen

Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark

ABSTRACT

The egg mass of the prosobranch *Melo miltonis* (Griffith and Pidgeon, 1834) from the southern Australian region is described in some detail and figured. It is one of the largest known prosobranch egg masses, consisting of about 100 spirally arranged capsules, each containing a single embryo, measuring 26 mm at hatching. The reproductive strategy in the Volutidae is summarized.

INTRODUCTION

During the "Fifth International Marine Biological Workshop: The Marine Flora and Fauna of Rottnest Island, Western Australia, 8-26 January 1991" an egg mass assigned to the prosobranch gastropod *Melo miltonis* (Griffith and Pidgeon, 1834) was obtained.

Melo miltonis (Family Volutidae) is a common prosobranch gastropod of the southern Australian region. It has been recorded from off Pt. Brown, near Ceduna (about 134°E, 32°S), along the coast of Western Australia to Houtman Abrolhos and Bluff Pt. (about 114°E, 28°S). It is found from the littoral to 20 m depth on sandy bottom. It attains a shell length of 445 mm (Weaver and du Pont, 1970; Wells and Bryce, 1989).

The egg mass of *Melo miltonis* was described and figured by Cotton (1937; 1944; 1949). His description is brief and the figures (photographs) are rather obscure. In order to distinguish the egg mass of the present species from that of other species of the genus *Melo* a more detailed description and more detailed figures are needed.

MATERIAL AND METHODS

The following material has been available:

1) An egg mass obtained by diving off Rottnest Island on 16 January, 1991, depth unknown. After being photographed, 10 egg capsules were cut off and preserved in 10% formalin. The egg mass was then returned to its habitat.

2) Ten dry egg capsules and 10 embryos ready to hatch presented to (the late) Professor G. Thorson by Mr. B.C. Cotton. The sample is now kept in the Zoological Museum, University of Copenhagen. Thorson softened the sample, whereby the original shape of the egg capsules was re-established. The sample is a subsample of the egg mass from Ceduna, South Australia, recorded by Cotton (1944).

Identification: The animal producing the egg mass from Ceduna was secured; it had a shell length of 250 mm. At the site of collecting a further specimen was observed in the process of producing a similar egg mass (Cotton, 1944). No female was secured together with the Rottnest egg mass, but it agrees in all details with the Ceduna egg capsules of the Zoological Museum. *Melo miltonis* is by far the largest species of the family in southern

Figure 1. *Melo miltonis*. Egg mass, Rottnest Island, 16 January, 1991, x 0.5. Drawn after a photograph.

Australia. It is not feasible that some other species of the region should be able to produce an egg mass of that size.

The nomenclature and distribution data are in accordance with Weaver and du Pont (1970).

RESULTS

The egg mass is roughly cylindrical ("the shape of a pineapple"), broader near the base, which is indicated by the adhesion of shell fragments, sand and gravel. The height is about 250 mm, the largest diameter, at about one-third the distance from base, is about 150 mm. It consists of about 100 individual egg capsules, arranged in a spiral, leaving a central interior space, which contains two detached egg capsules.

The shape of the egg capsules varies considerably. The exterior surface has a rounded basal extension. The apical edge forms two arched ridges running down the lateral edges.

A median ridge divides the exterior surface into two concave halves. The interior surface bulges heavily into the central cavity. The capsule wall is thick, cartilaginous and somewhat opalescent. It consists of two layers: a thick, external layer covering the peripheral half of the egg capsule and a 1 mm thick internal layer forming the egg capsule proper. A similar structure was observed by Tokioka (1962). The egg capsule contained a clear fluid which, some time after preservation, was transformed into a filamentous mass. Each capsule contains 1 embryo. The Rottnest sample contains discoidal embryos with 1.5 whorls and measuring 400 µm across, apparently consisting of periostracum only. At an advanced stage of development all embryos are orientated with their apices towards the outer wall and the anterior canal occupying the internal bulge. The embryo ready to hatch has a shell length of 26 mm. It has about four whorls, a flat spire with a deep suture. The nuclear whorl can be distinguished; the postnuclear shell has irregular, subsutural, curved furrows. The columella has four plaits. None of the hatching embryos from Ceduna contained soft parts. Between the individual capsules narrow slits lead into the central cavity.

DISCUSSION

Dall (1907) stated that the egg capsule and protoconch might provide important systematic characters in the Volutidae. Until now only a few species have been studied. The egg masses and reproduction are only briefly referred to by Weaver and du Pont (1970).

Smith (1910) described an egg mass of *Melo* sp. from off Dunk Island, Queensland. It had the shape of an elongate fircone, with only a single embryo in each capsule; no figure is given.

Stephenson *et al.* (1931) published a very obscure photograph of a female *Melo diadema* Lamarck, 1811 (= *M.* (*Melocorona*) *amphora* (Lightfoot, 1786)) producing an egg mass. The observation was made at Low Island, Great Barrier Reef, Queensland. No comments are given.

Cotton (1937, 1944, 1949) and Cotton and Godfrey (1942) identified and described the egg mass and embryo of *Melo miltonis*. The former paper gives an obscure photograph showing the egg mass upside down. The present egg mass corresponds in all details with the observations made by the authors just mentioned.

Wilson and Gillett (1971) observed the completion of an initiated egg mass of *Melo miltonis*. After capture the female re-occupied its position on the egg mass containing some 50 egg capsules. After 10 days an additional 20 egg capsules had been added. The egg mass was now completed and the female left it. Individual egg capsules each contained a single large larva which hatched directly without a pelagic stage. Wilson and Gillett (1971) discuss the restricted distributions of many species of Volutidae in relation to the prevailing non-pelagic larval development. A photo of the dried egg mass of *M. miltonis* is given.

Tokioka (1962) described and figured an egg mass from the Arafura Sea which (with some doubt) was assigned to *Memo ducale* (Lamarck, 1811) (= *M.* (*Melocorona*) *umbilicatus* Broderip in: Sowerby I, 1826). The egg mass is 250 mm long, cone-shaped with a central cavity with about 140 capsules. Each capsule contains 1 embryo, about 22 mm long. Excellent figures are given.

Amio (1963) described the egg mass of *Melo* (*Melo*) *melo* (Lightfoot, 1786) from the waters off southern Japan, giving a brief description and some very obscure photographs. The egg mass is cylindrical with a central space and bulging egg capsules. One embryo is present in each capsule, hatching at a size of about 30 mm which means a direct development.

The reproduction of 5 species of Volutidae from the coasts of the Americas have been

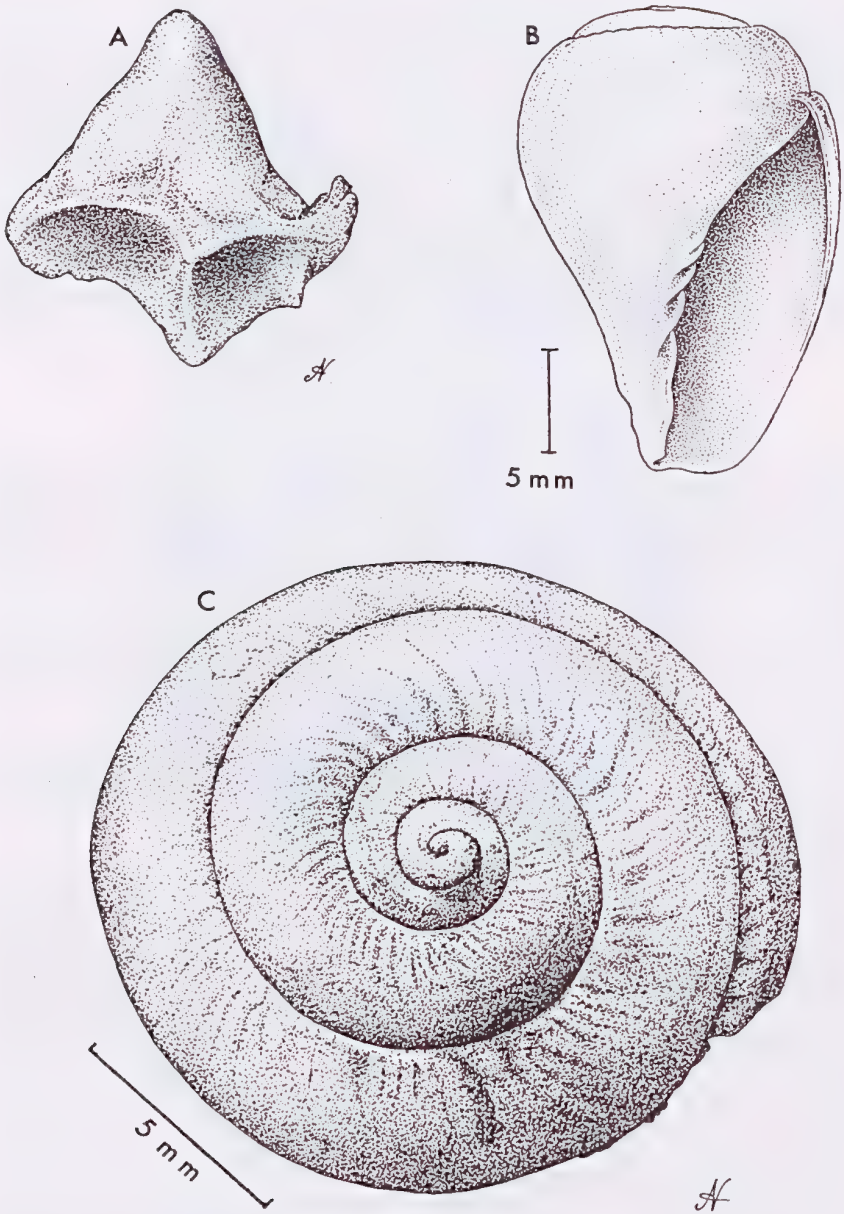

Figure 2. *Melo miltonis*. A, apical view of a single egg capsule, Rottnest Island, 16 January, 1991, natural size. B, frontal view of hatching embryo, Ceduna, South Australia, B.C. Cotton (1944). C, apical view of hatching embryo, Ceduna, South Australia, B.C. Cotton (1944).

described (Clench and Turner, 1964; Penchaszadeh, 1988: *Odontocymbiola magellanica* (Gmelin, 1791), *Zidona dufresnei* (Donovan, 1823), *Adelomelon ancilla* (Lightfoot, 1786), *Adelomelon brasiliana* (Lamarck, 1811), and *Voluta musica* Linnaeus, 1758). The species mentioned appear to have homogeneous reproductive strategy: they produce large solitary egg capsules with few eggs; the development is direct and the hatching young may attain a shell length of more than 10 mm. The egg capsule of *Adelomelon brasiliana* is globular with a flattened base and measures 90x100 mm. It contains 5-15 embryos and is one of the largest known prosobranch egg capsules.

The reproductive strategy of *Cymbium* was studied by Marche-Marchad (1968, 1980). The genus, comprising 9 taxa, is endemic to the West African region, extending to the south coast of Portugal and the western Mediterranean. The female produces large egg capsules which are incubated in the pedal gland. The egg capsule contains several thousand eggs, measuring 100-150 µm. The larger eggs serve as nurse eggs and 4-46 of the smaller eggs develop into veliconcha embryos hatching at a size of 20-30 mm.

Thus in the Volutidae three different reproductive strategies are found:

1) Large solitary capsules resting on the sea bottom: American waters.

2) Incubation of egg capsule in the pedal gland: West African region.

3) A composite egg mass with numerous capsules: Indo-Pacific region, Australian waters.

All three strategies result in a small number of large embryos having a direct development.

ACKNOWLEDGEMENTS

Thanks are due to the divers of the workshop for collecting the egg mass and for returning it to its habitat, to Dr. K. Jensen for taking the photo, to Mrs. E. Højgaard (typing) and to Ms. A. Vedelsby for the drawings (Figs 1, 2A,C).

LITERATURE CITED

Amio, M. 1963. A comparative embryology of marine gastropods, with ecological considerations. Journal of Shimonoseki University of Fisheries 12: 229-358 (15-144). (In Japanese, English summary).

Clench, W.J. and Turner, R.D. 1964. The subfamilies Volutinae, Zidoninae, Odontocymbiolinae and Calliotectoninae in the Western Atlantic. Johnsonia 4, 43: 129-180.

Cotton, B.C. 1937. Eggs and egg cases of some southern Australian Mollusca. Rec. South Aust. Mus. 6(1): 100-103.

Cotton, B.C. 1944. The egg capsule of the Southern Australian baler shell *Melo miltonis* Gray. Rec. South Aust. Mus. 8: 143-144.

Cotton, B.C. 1949. Australian Recent and Tertiary Mollusca family Volutidae. Rec. South Aust. Mus.: 181-196.

Cotton, B.C. and Godfrey, F.K. 1942. The protoconch or embryonic shell of the gastropod. South Aust. Nat. 21: 6-10.

Dall, W.H. 1907. A review of the American Volutidae. Smithson. Misc. Coll. 48: 341-373.

Marche-Marchad, I. 1968. Un nouveau mode de dèveloppement intracapsulaire chez les Mollusques prosobranches nèogastropodes: l'incubation intrapèdieuse des *Cymba* (Volutidae). Compte rendu hebdomadaire des sèances de l'Academie des sciences. Sèr. D. 266: 706-709.

Marche-Marchad, I. 1980. Sur la stratégie de la reproduction chez le genre *Cymbium* Röding 1798 (Gastropoda, Volutidae). Haliotis 10, 2: 94.

Penchaszadeh, P.E. 1988. Reproductive patterns of some South American Prosobranchia as a contribution to classification. Malacol. Rev. Suppl. 4: 284-287.

Smith, E.A. 1910. Note on the egg-capsules of *Melo*. Proc. Malac. Soc. Lond. 9: 4-5.

Stephenson, T.A., Stephenson, A., Tandy, G. and Spender, M. 1931. The structure and ecology of Low Isles and other reefs. Sci. Rep. Great Barrier Reef Exp. 1928-29. 3, 2: 17-112.

Tokioka, T. 1962. Record of a giant egg mass of *Melo ducale* (Lamarck) from the Arafura Sea. Publ. Seto Mar. Biol. Lab. 10, 1: 21-25.
Weaver, C.S. and du Pont, J.E. 1970. The Living Volutes. Delaware Mus. Nat. Hist. Monogr. Ser. 1: 1-375.
Wells, F.E. and Bryce, C.W. 1989. Seashells of Western Australia. Western Australian Museum, Perth. 207 pp.
Wilson, B.R. and Gillett, K. 1971. Australian shells. A.H. and A.W. Reed, Sydney. 168 pp.